Chapter 4
Agent-Based Approach to Customers' Flow Modelling

ABSTRACT

Agents are relatively autonomous computational objects. They can slightly differ in values of their properties, called attributes, and can as well have different number of quite different properties. Agents exchange messages and carry out activities influencing other agents and environment. Agent activities are defined by its own rules that can be static or dynamic. Simulation of various phenomena using agents are called agent-based modelling (ABM). ABM enables observation and investigation of processes that are complicated to be modelled by other modelling means. The purpose of this chapter is to demonstrate the agent-based approach for modelling and analyzing agents-customers flow to shops or service places. Each agent randomly with defined probability decides if the service is to be booked or not. Flow of customers is modelled by another kind of single agent environment. This real-world process modelling by means of agents enables to collect statistics and to compare outcomes with similar analytical results.

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INTRODUCTION

Bursts (packets of consecutive events) may appear in various technical, business and social systems. Performance prediction under burstiness is a challenging task (Casale, Kalbasi, Krishnamurthy, & Rolia, 2012). In data transmission the burstiness of bit-errors is defined as two or more bits in a row that have been changed (Grami, 2016). The measure of quality of data bit sequence transmission is measured by bit error rate

$$BER = \lim_{N \to \infty} \frac{n}{N},$$

where *N* denotes the length of bits sequence and *n* denotes the number of bit errors in the sequence (Haykin & Moher, 2006). This definition of bit error rate corresponds to the statistical definition of probability of any random event.

Therefore, the statistical analysis based on bit errors rate BER may be transferred to the flow of other kinds of events that randomly occur in social domains and business processes as it is discussed in the first chapter of this book.

The analysis of events' flow mostly has been the object of the queueing theory. The queueing theory is a mathematical tool for the performance evaluation of systems (Sztrik, 2016). It deals with probabilistic properties of the incoming flow of requests, service times and service disciplines. However, the request's probability in the flow of events does not deliver enough information about how concentrated the requests may be (Ahrens, Purvinis, Zaščerinska, & Andreeva, 2015). The analysis of concentration is of special importance in business processes, for instance, for analysis of consumers decisions to buy a good or a service.

It should be noted that consumer decisions and behavior depends on various circumstances and factors. The analysis and modelling of observable consumer's behavior should include qualitatively different patterns (Albanese, 2006). To develop a pure mathematical model for the qualitatively observable phenomena may be a challenging task. When the mathematics is intractable, then an agent-based approach may provide a useful multidisciplinary tool (Axelrod, 2006). The agent may be rule-driven and therefore is able to take into account qualitative factors of the environment.

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